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ABSTRACT

This paper discusses how John Dewey's logic in his theory of inquiry can inform and perhaps guide efforts to re-form education and to allow the creative forces of emergence to affect and create adaptive social systems as learning organizations. The paper contends that Dewey's naturalistic theory of experience predated yet anticipated the discourses of complex adaptive systems (CAS) theories (Maturana, 1980) and social autopoiesis (Luhmann, 1995). It finds that these varying perspectives can be engaged dialectically to provide insights into school re-form and (r)evolution. Visions of schooling must proceed from the multiple discourses of postmodern meaning rather than the mechanistic perspectives of production models. Contains 3 figures and 23 references. (BT)

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by M. Jayne Fleener

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Dewey's Logic and Social Autopoiesis: Creative Forces for/of Social (R)evolution

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Abstract

I will discuss in this paper how Dewey's logic as his theory of inquiry can inform and perhaps guide our efforts to re-form education and to allow the creative forces of emergence to affect and create adaptive social systems as learning organizations. Dewey's naturalistic theory of experience predated yet anticipated the discourses of complex adaptive systems (CAS) theories (Maturana, 1980) and social autopoiesis (Luhmann, 1995). These varying perspectives can be engaged dialectically to provide insights into school re-form and (r)evolution. Visions of schooling must proceed from the multiple discourses of postmodern meaning rather than the mechanistic perspectives of production models.

Dewey's Logic and Creative Activity

Dewey's naturalistic conception of logic grounds his approach to meaning and knowledge in the pragmatic realm of inquiry. Following the pragmatism of Peirce, Dewey first conveyed his ideas about the logic of inquiry in his early works

> in the context of trying to understand the reciprocal relationships between learning and experience, knowledge and action, and other disparate features of human nature which are ordinarily not considered to be a part of the subject matter of logic. (Burke, 1994, p. 4)

This approach to meaning recognizes the dynamic relationship between perception and knowledge and organism and environment, and challenges traditional views of logic as either deductive or inductive approaches to inquiry.

> We have seen how the opposition between knowing and doing, theory and practice, has been abandoned in the actual enterprise of scientific inquiry, how knowing goes forward by means of doing. ... The old knowing was mind knowing by means of an equipment of powers complete within itself, and merely exercised upon an antecedent external material equally complete in itself. The new center is indefinite interactions taking place within a course of nature which is not complete, but which is capable of direction to new and different results through the mediation of intentional operations. (Dewey, 1929, pp. 290-291)

Thus, Dewey views the organism/environment relationship as a system and inquiry as an approach to altering the organism/environment complex. Knowledge itself then becomes a complex relationship between organism and environment. The potential of an organism/environment system for action, according to Dewey, is related to the current similarity of present environmental conditions with past formation of habits as actions related to the resolution of situational conflict, and the flexibility or adaptability of the system. Habit formation can have a biological base but, for humans, culture and tradition also play a part.

Dewey's logic provides a perspective from which schools and social organizations can be explored as well. Perhaps the transformation and adaptability of schooling will occur because of a change of ways of seeing rather than due to instrumental changes imposed through rational processes. As discussed by Bredo (2000),

> Schools and other organizations are commonly analyzed in rational terms with their organizational structures viewed as means to given social ends. Reformers commonly adopt a rational perspective, as well, suggesting ways in which schools may be more efficient in achieving specific goals. (p. 230)

An apocryphal story about von Glassersfeld relates to this point. During a discussion of the ontological and epistemological implications of his radical constructivist perspective, he was asked whether, if he could see the wall

differently, as largely comprised of vast space, would he be able to walk through it? His response was "absolutely." This, perhaps, is the key to educational reform, namely, not to bring forth plans of action for change, but to simply assume a different perspective. Along with that perspective comes a vision. Dewey's theory of inquiry offers a non-mechanistic, evolutionary perspective. Complex adaptive systems theory provides another perspective of evolutionary dynamics and methodology that complement Dewey's naturalistic philosophy and logic as inquiry. Together, a method of envisioning possible educational futures can be explored and, perhaps, this vision will allow us to walk through the wall of traditional educational reform approaches and practices.

Dewey's Logic and Transactional Theory

Dewey distinguishes between 'relationships' during interactions within situations and 'transactions.' Like Whitehead, Dewey considers basic existence to be events. Bateson similarly posited the axiom of Metapattern whereby fundamental existence is based on interactive relationship rather than atomic bits of matter. The focus on relationship or events rather than "things" or matter as the basis of all being is likewise consistent with quantum reality.

Relationship as events, according to Dewey, can be actual or potential. Transactions include not only the actually occurring interaction but all possible interactions as well. Reality, for Dewey, is the complex matrix of all possible interactions or transactions in any given situation. Our transactions define the continuum of our lives in a complex web of potential and actual. "'Experience' is a specification of 'transaction'" (Biesta, 1995, p. 111). Growth is the expansive and rhythmic proliferation of transactions and the actualization of potentialities.

The transactions that define our lives are as much a part of our realities as the actual interactions. As we creatively explore potential relations to guide our actions and ultimately select from among them, we impact and influence later events and possibilities. The actualization of potentialities is itself a creative process. The relationship between expansive transactional spaces and creativity defines Dewey's aesthetics, relating it to his logic as inquiry. Thus, the relationship between Dewey's aesthetics and his approach to practical reasoning and inquiry make Dewey's aesthetics an integral part of rather than a separate component of his system of thinking about process, meaning, experience and inquiry.

Dewey's transactional theory, including his aesthetics and logic, are key elements of his organocentrism. These components of Dewey significantly anticipate and are consistent with systems theoretic attempts to describe emergent and dynamic relationships. Holder (1995) describes Dewey's logic as leading to what he defines as "naturalistic emergentism" whereby

> cognitive experience is emergent from and pervaded by noncognitive experience (e.g., emotions, habits and imagination). Only in a naturalist epistemology, that is, in an epistemological framework where cognitive processes such as thinking involve *noncognitive* structures of experience in an essential way, can the puzzle of rationality/creativity be resolved. (p. 8)

Systems thinking and New Science significantly expand Dewey's notions, providing the basis for understanding the world in non-mechanistic ways. Complex adaptive systems (CAS) theories consider the emergent behaviors of open systems as reflective of creative reorganization or restructuring resulting from organism/environment interactions. Dewey's logic and his philosophy of experience have some relevance for understanding how CAS evolve. CAS

theory explores the viability and fitness of evolving systems as well as the dynamics of evolution. Both CAS theories and Dewey's naturalistic philosophy can be applied to social structures to understand how social organizations can interact in intelligent and self-preserving ways while also engaging in self-renewing and evolutionary transactions. The notion of social/organizational beliefs will be explored as essential for engaging social systems' emergent potentials. Holder's naturalistic emergentism will be explored from the perspective of social organizations and expanded below. Following is a brief review of CAS theory especially as it relates to social systems and creativity.

Complex Adaptive Systems and the Creative Forces of Autopoiesis

This section of the paper will offer the perspective that Dewey's philosophy of experience and logic are consistent with current thinking about living systems as complex adaptive systems (CAS). The pattern and processes of organization in living systems is defined by Maturana and Varela (1980) as autopoiesis. The origin of the word emphasizes the notions of self renewal and creative adaptation, production, and autonomy. Autopoietic systems, therefore, are self-producing systems, organizationally closed while dialectically interacting with their environment. Boundary, production, and organization both limit and define the historical and biological evolution of an autopoietic system. By shifting focus from defining characteristics of living systems to the process of self-creation through self-perpetuation and self-generation, Maturana has significantly altered the perspective from which living systems can be examined. As described by Varela (1981)

> Informational and functional notions need not enter into the characterization of the living organization, as they belong to a domain different from the relations that define the system. Thus we proposed a critique to the current use of such notions as unnecessary for the definition of the logic of life, and claimed autopoiesis as necessary and sufficient to define the living organism, and, a fortiori, the phenomenology of the living. (p. 37)

Relational qualities are built in to the very being of autopoietic systems through their structural plasticity. As self-organizing, self-moderating, self-referential systems, with the property of structural plasticity, living systems adapt through the process of structural coupling. Structural coupling is the process whereby autopoietic complexities interact with their environment. As with Dewey's naturalism, the transactional relationship between an autopoietic system and its environment is naturalistically and dialectically defined. Survival is often a function of the expansive transactional potential of a species and fitness is defined as the potential for adaptive behavior in changing and complex environments.

The development of communications is important for the emergence of cognition and structural coupling of humans within a social domain. An examination of the role of language in emerging social structures is presented below. As Mead (1967) discussed in *Mind, Self and Society*, social dimensions are reflections of and dialectic with the emergence of mind and as Dewey explains, language and communication provide for intelligent, adaptive behavior and reflective critique of habitual behavior. Early systems theorist Lee Thayer similarly extolled the use of systems theory to explore communication systems. He explained this approach requires (Thayer, 1975) rejecting linear, information-theoretic models of communication as "transmission of meaning" in favor of complex

understandings of the dialectical and emergent characteristics of communications. Such an approach has been explored from a complex adaptive systems perspective.

Language and Social Systems

Mingers (1995) applies Boulding's (1956) classification scheme for complex systems to Maturana to explain the role language plays in human development and social systems. Building on relationships within the system, a hierarchy of levels of complexity was proposed (see Figure 1). The proposed hierarchy is useful for understanding linguistic relationships within Maturana and Varela's framework and for understanding change as a creative, reflexive process. Coordinated communication about communication and the assignment of language to signify abstract concepts fall within the network of structural coupling at the highest level of complexity, social structures. Thus, social systems are

> network(s) of co-ordinates of actions. ... As such, a social system is a dynamic system in a continuous flow of changing co-ordinations of actions that remains the same as long as these stay contained within the configuration of co-ordinations of actions that defines it as a particular social system. (Maturana, 1988, pp. 67-68).

Insert Figure 1 about here

Luhmann's theory deliberately addresses and reconceptualizes social relationships as autopoietic structures.[1] Rather than defining social systems as consisting of living beings, Luhmann describes social structures as communication systems. This move to redefine the autopoietic reproductions of social structures as communications, instead of a collection of individuals, focuses on meaning structures as the medium for communications. As described by Knodt (1995),

> Luhmann …reconceptualiz[es] the social in such a way that it does meet the condition of autopoietic closure. All we have to do, he proposes, is ... to think of them instead as systems whose basic elements consist of *communications*. ... [S]ystems that operate on the basis of consciousness (psychic systems) or communication (social systems) require meaning (*Sinn*) for their reproduction. ... [M]eaning itself ... designates the medium through which social systems process world-complexity.

By providing a different perspective of psychic and social systems as separate from biological systems, *consciousness co-emerges with social structures within and through meaning relationships*.

Luhmann provides a poststructural view of language when defining the characteristics and origins of communication that is consistent with the naturalistic approach of Dewey. According to Luhmann, denying pre-existing language structures, communication evolves as a self-determined, self-generating system, which may include, but is not reducible to, language use or action-constitutive approaches to meaning. This also implies the transactions among individuals within their cultural environments and social institutions allow for the creative, self-expansive evolution of social organizations that is not reducible to or dependent upon the individuals who are in

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[1] Maturana and Varela disagree that social systems can themselves be autopoietic but instead argue that social systems are the medium in which humans as autonomous complex systems interact.

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relation with the organization. This naturalistic approach provides some compelling basis for the view of social structures and culture as being continuous with living systems and as being autopoietic. As described by Holder (1995),

> [N]aturalism means that a description of any event can be given without reference to the transcendental or supernatural. In effect, higher mental processes are said to be *continuous* with lower ones (e.g., thinking with the biological pattern of need and search), but such "higher" processes are *not* reducible to lower ones (e.g., thoughts are *not* reducible to brain states). (p. 22)

Dewey's naturalism provides a seamless approach to meaning and knowing as social constructs within a naturalistic perspective and a framework for exploring inquiry and social relations as autopoietic structures. As Dewey describes it (1938),

> The term "naturalistic" has many meanings. As it is here employed it means, on one side, that there is no breach of continuity between operations of inquiry and biological operations and physical operations. "Continuity," on the other side, means that rational operations *grow out of* organic activities without being identical with that form from which they emerge. ... [M]an is *naturally* a being that lives in association with others in communities possessing a language, and therefore enjoying a transmitted culture. Inquiry is a mode of activity that is socially conditioned and that has cultural consequences. ... [I]n every interaction that involves intelligent direction, the physical environment is part of a more inclusive social or cultural environment. (pp. 18-20)

Social organizations, like schools, are continuous with the expansive transactions of individuals. The transactional spaces of social organizations can be explored as evolutionary dynamics of living (communication) systems. If the goal for individual action is the proliferation of possible activity throughout the expansion of the transactional space for that individual, we can similarly examine the fitness of social organizations from the perspective of expanding transactional spaces.

Fitness of Social Organizations as Expanding Transactional Spaces

Goertzel (1993, 1997) defines fitness as relating to emergent pattern. In organisms, for example, he relates structural fitness to the complexity and kind of patterns that emerge as the organism interacts with its environment. Thus, humans are structurally more complex than single celled animals and more fit because of the complexity of ways humans can interact with their environment. Structural fitness is a measure of the adaptive potential of an organism in interaction with its changing environment or, in Dewey's terms, an indication of the expansiveness of the transactional space.

Interactive complexity is captured in phase space dynamical representations of open and closed systems. Figure 2 compares closed system dynamics (Minger's level 3), with open system dynamics, (Minger's level 4). The first two diagrams, of a pendulum in Figure 2a that is allowed to run down and a pendulum in Figure 2b that has a continual supply of energy to provide for perpetual motion, show how the dynamics of the system follow a predictable path and steady-state. The third diagram in Figure 2, however, shows how, despite boundaries, the dynamics of a complex system are unpredictable and indeterminate.

Insert Figure 2 about here

Schools, as they are now conceived, have proven themselves to be structurally unfit due to their lack of ability to adapt to changes in society. In the constant struggle between stasis and adaptive change, schools have proven to be caught in a negative feedback loop (closed systems, level 3, Minger's hierarchy), reacting to interactive perturbations not to change but to maintain status quo. Thus, while school reform has predominated the energies of those involved in schooling and the literature about schooling, attempts at reform have been crisis driven rather than positively envisioned. Breaking out of our traditional ways of thinking has proven to be difficult, especially since change itself has been viewed from a mechanistic perspective.

For individuals, Dewey described the roles of creativity and inspiration for breaking out of habitual action. To engage social organizational transactions as emergent and expansive potential action and to expand the fitness potential of schools as social structures, creativity and inspiration may be meaningfully explored from a social systems perspective.

Creative Emergence of Schools

The relationship between habitual action and creative activity is an important aspect of Dewey's logic as inquiry. Thinking drives problem solving even at the most basic level. Dewey's notion of thinking includes intuition, instinct, feelings, imagination, and creativity as well as cognition and integration. As described by Holder (1995),

> James and Dewey viewed thinking as a process emergent from and continuously controlled by noncognitive levels of experience, levels that include experiential structures such as emotion, habit, and imagination. According to them, thinking is one kind of highly structured experience that emerges from and retains in an essential and dynamic way less structured experience. Both James and Dewey rejected cognitivist models of mental operations, because such models mistakenly maintain that structure exists only in the so-called cognitive aspects of the mind. (pp. 11-12)

As we engage in problem solving, passion, creativity and imagination as integral aspects of thought are involved as well as habit and logic as practical reasoning. Problem solving therefore is a fundamental human activity, for Dewey, and thought, as a human approach to solving problems, includes multiple 'ways of knowing' beyond the traditional perspective of logical thought.

Meaningfulness includes an integration of embodied experiences including feelings, cognition, and aesthetic value manifested through action within a social network. Experience in a social environment therefore becomes imbued with a sense of purpose that drives further interactions and experience. In this way, experience, meaning, and reflection become inextricable as do thought, intelligence, and problem solving. As we creatively explore potential solutions to guide our actions and ultimately select from among them, we impact and influence later events and possibilities. The actualization of potentialities is itself a creative process which is how Dewey's aesthetics relates to his transactional theory of reality and his logic. The rhythmic interplay of conflict and resolution, disequilibrium and equilibrium, defines our on-going transactions with our environment.

Creativity is thus an important part of our transactional space. In this way, morality, valuing, and aesthetics are dimensions of action driven by meaning. As described by Alexander (1995),

> This experience is not necessarily cognitive so much as a total integration of feeling and meaning embodied and expressed through activity in some medium that is socially expressive. Experience becomes charged with a sense of fulfillment and meaning when it is growing and expressive. The skills to develop such experiences Dewey alternatively called "education" or "art." Quite simply, the aim of life is to experience the world aesthetically. (p. 78)

Educating for moral action and aesthetic experience requires, according to Dewey, nurturing imagination. Imagination and reflective abstraction allow for the playing out of possibilities as we struggle for resolution in problematic situations. Engaging the creative imagination and thoughtful deliberation of potentialities are often bypassed by thoughtless action, an over-reliance on tradition, or a pattern of action defining our own habits of interaction. What is worse is that education often provides experiences that disempower students for enlisting their creative imaginations. As described by Fesmire (1995),

> There are times when we plod along in a horizon-less daze. At other times, we are ecstatically focused on a future end to the impoverishment of present imagination. In both cases, our dramatic rehearsals are abbreviated. When our imagination is contracted, we do not attend to the world's possibilities. ... [E]ach time we approach a project as an externally imposed burden to be borne, we scoop out just a little more dirt for a grave in which to bury our imaginations. (p. 53)

The cyclical, on-going dynamics of inquiry as it relates to imagination, creativity, reflection, and problem solving is explored in Dewey's logic as his approach to inquiry. (See Figure 3.) Deliberate, reflective inquiry defines the dynamics of growth in thinking and reorganization of experience. As Dewey (1920) describes the process:

> If thinking is the way in which deliberate reorganization of experience is secured, then logic is such a clarified and systematized formulation of the procedures of thinking as will enable the desired reconstruction to go on more economically and efficiently. (pp. 134-135)

This process is social in nature and grounded in the language dynamics of communities of thinkers reflecting on problematic situations. As explained by Nagel (1968),

> The occurrence of qualitative perceptions, reveries, speculations, and fancies in contexts other than that of inquiry is controlled by habit, chance circumstance, or native propensity. But within a reflective context the situation is otherwise. The nature of the problem in situations involving felt difficulties does not usually spring into full view immediately, and must be sought for and identified. Observation then becomes controlled by suggestions or hypotheses, and sensory qualities are not received passively but are deliberately selected and isolated from a larger qualitative context. The identification of the problem is thus achieved neither by subcutaneous thought nor by random activity but by overt activity controlled by ideas. Moreover, when the problem has been located, attempted solutions of it involve further controlled observation, instituted by hypotheses for the sake of obtaining factual evidence for them. Accordingly, sense and reason are co-operatively engaged throughout controlled inquiry. (pp. 69-70)

The cyclical, dynamic nature of the inquiry process ensures the transformation and reconstruction of thought and the expansion of discursive possibilities. Complex adaptive systems theories and chaos dynamics may provide alternative ways of seeing so that, within a Deweyan framework of naturalistic inquiry, we may transcend our current debates about educational reform.

Insert Figure 3 about here

Creative emergence in schools as problem solving activity in line with Dewey's method of inquiry is also possible within a dynamical framework of social systems as complex adaptive systems. If meaning structures define the social structure as a self-renewing, self-creating, autopoietic complex, an important aspect of social reform must include creativity, reflectivity, imagination and thought. Postmodern, ecological process theories from a complex adaptive systems perspective offer the meaning system from which schooling can be re-examined, renewed, and (r)evolved.

Changing Visions

Capra, in his movie *Mindwalking*, based on his book The Turning Point, (Capra, 1982), engages the perspectives of the pragmatic politician, romantic poet, and quantum ecological physicist in a discourse about science, society and culture. At the culmination of lengthy and at times contentious discussion, the politician reveals his understanding of their discussions, still from a mechanistic perspective, as what is needed is a change of perspectives. The poet's response is "No, Jack, what is needed is a change of vision." While changing perspective challenges our ways of thinking, new visions guide and imbue action with meaning and purpose.

Both CAS theories and Dewey's naturalistic philosophy can be employed to re-vision social structures to understand how social organizations can interact in intelligent and self-preserving ways while also engaging in self-renewing and evolutionary transactions. Both perspectives provide alternatives to mechanistic ways of thinking about social organizations, in general, and schools, in particular. This re-visioning fundamentally affects the kinds of problems we define, how we reflect on those problematic situations, what we observe as problematic, and ultimately, how we approach solutions to our problems. Wittgenstein (1953) explored this Gestalt shift of ways of re-visioning as he described the subtle yet important difference a "change in aspect" can have on how we see things.

> The expression of a change of aspect (emphasis added) is the expression of a new perception and at the same time of the perception's being unchanged. ... 'Seeing as ...' is not part of perception. And for that reason it is like seeing and again not like. (pp. 196-197)

Dewey's logic as problem solving and transactional theory provide a perspective, a change of aspect, from which schools and social organizations can be explored. Creativity and inspiration become key features of expanding the transactional spaces of schools as social organizations.

CAS provides another perspective for understanding the evolutionary dynamics of autopoietic systems and their need for adaptive potential and fitness. Schools as social structures can be explored as autopoietic systems for their adaptive potential. Social systems theory as meaning systems provides another view of schools, allowing challenges to existing structures based on the absence of meaning and value inherent in mechanistic approaches to

schooling. Fitness in the social sense can be explored from this perspective of meaning and potential for expansive reaction to the changing social environment.

These various perspectives, however, are just perspectives until a vision of schooling can be created that truly allows for the expansive potential of educative experiences within the social system of schooling. The transformation and adaptability of schooling will occur because of a change of vision informed by these multiple perspectives rather than due to instrumental changes imposed through rational process or mechanistic action. Just as putting on a new pair of glasses requires some adjustment period, our lens of CAS makes it difficult at times to even focus on what the problems are that we need to address. It is clear, however, that the problems are not the ones we thought they were. As in the story about von Glassersfeld, if we can see the wall of traditional education differently, as largely comprised of vast space or entrenched in traditional mechanistic discourse, we can perhaps learn to "walk through it" or envision it differently. Vital to this process of educational reform is not the making of new plans but the envisioning of different realities.

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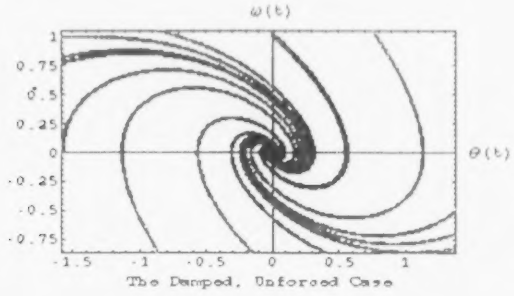
Figure 1: A Hierarchy of Complexity (Adapted from Mingers, 1995, pp. 81-82)

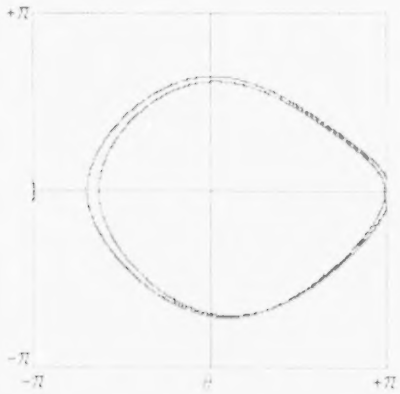
Level	Characteristics	Types of Relations	Examples	Domain	Discipline
1. Structures & Frameworks	Static	Topological constitution	Bridges, mountains	Mechanical systems	Descriptive
2. Simple dynamics, Mechanistic	Ordered/open	Predetermined motion, isolation of parts	Solar system, Mechanical clocks, machines	Mechanical physics, systems	Natural sciences
3. Self-regulating systems	Closed-loop control, homeostasis	Negative feedback	Body regulation, Thermostat	Equilibrium Dynamics	Cybernetics
4. Open systems, Living systems	Structurally self-maintaining, Self-producing	Autopoiesis, singular	Cell, Flame	Nonequilibrium dynamics	Theory of metabolism
5. Multicellular living organisms	Organized whole, structural coupling of parts	Second-order autopoiesis & interaction with parts	Plants, Fungi	Dynamical systems, Complex Adaptive Systems	Botany
6. Closed organisms with nervous systems	Ability to learn	Interactions with relations	Animals	Linguistic	Zoology
7. Observational systems	Language, Self-consciousness	Relations of relations	Humans	Consensual	Psychology, Biology
8. Sociocultural systems	Communication	Third-order autopoiesis, structural coupling of meaning systems	Families, Colonies, Swarms	Social	History, Anthropology

Figure 2: Phase Space diagrams of Closed and Open systems

a. Pendulum motion in phase space with dampening



b. Closed-loop pendulum without entropy



c. Lorenz attractor – Open systems (e.g. weather)

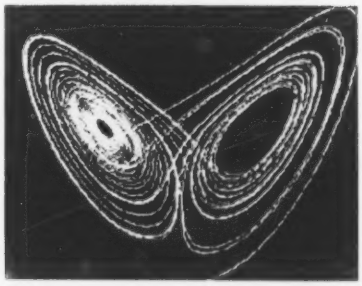


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Figure 3: Creativity, Reflectivity, Imagination, and Thought in the Inquiry Process

(On a separate file)

Figure 3: Creativity, Reflectivity, Imagination, and Thought in the Inquiry Process